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ILLINOIS
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CHIEF CLERK'S OFFICE

REBUTTAL TESTIMONY

OF

QIN LIU

TELECOMMUNICATIONS DIVISION

ILLINOIS COMMERCE COMMISSION

AMERITECH ILLINOIS
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Part I. GENERAL INTRODUCTION

Q. Please state your name and position.

A. My name is Qin Liu and I am a policy analyst in the Telecommunication Division of the Illinois Commerce Commission. My business address is: 527 E Capitol Ave., Springfield, IL 62601.

Q. Please describe your educational background and qualification.

A. I hold a BA degree in Mathematics and Statistics, and a M.A. degree in Economics. I have a Ph.D degree in Economics from Northwestern University, and have completed coursework for the Ph.D program in Urban and Regional Planning in the Department of Civil Engineering at Northwestern University. My main fields of specialization are Industrial Organization and Econometrics. I have been employed by Illinois Commerce Commission since September 1, 2000.

Q. Please describe the issues that you address in this testimony.

A. I will address the two most important and contested issues related to Ameritech Regional Switching Price Model (ARPSM): 1) the forward-looking prices of the elements in Ameritech's unbundled local switching offering and the Total Element Long Run

Incremental Cost (TELRIC) of these elements, and 2) the nature of CCS-related investment costs and the rate structure to recover these investment costs.

Part II: RESPONSE TO MR. PALMER'S REBUTTAL TESTIMONY

Part II.1: Forward-looking price of the switching equipment

Q. In a TELRIC analysis, the term "forward-looking" price/cost¹ is constantly used. Is Mr. Palmer's "forward-looking" price the same as the "forward-looking" price referred to in a TELRIC analysis ? If not, what are the distinctions ?

A. No. Mr. Palmer implicitly defines his "forward-looking" price as the single price equivalent generated by ARPSM, which Mr. Palmer uses as input in his TELRIC analysis (AI Ex. 2.1, p20:16-17, for example). Mr. Palmer's "forward-looking" prices should be labeled as the per-line "marginal cost" of acquiring the additional lines specified in the vendors' contracts.

The forward-looking price/cost referred to in a TELRIC analysis, in contrast, is based on the Total Element Long-Run Incremental Cost (TELRIC) of the network element.² The

¹ Price and cost are different in general. But in this context, they are two sides of the same coin. For example, the vendor's per-line price is Ameritech's per-line cost. And the UNE purchaser's cost is the UNE provider's price.

² For convenience, I treat CCS, line port and trunk port separately. For example, the TELRIC of line port is the total element long run incremental cost for line port only. Thus the TELRIC of the unbundled local switching (ULS) element (as defined by FCC) is the sum of the TELRICs for line port, CCS and trunk port (plus some other miscellaneous item such as MDF/DSX, INTERCEPT, DIRECTORY, etc.). The forward-looking price of ULS is derived by combining the forward-looking prices of line port, CCS and trunk port (plus miscellaneous items mentioned above). But it may not be a simple sum because different elements may have different rate structures. For example, line port is flat rated and trunk port is per MOU rated.

41 TELRIC of the switching element³ is (or should be) derived from the current (or relevant
42 future) network structure and market prices of that switching element. The forward-
43 looking price is, by definition, either the per-line TELRIC⁴ or per MOU TELRIC, or a
44 hybrid of the two, depending on the rate-structure of the elements. If the element is flat-
45 rated, the forward-looking price is simply the per-line TELRIC. If the element is per-
46 MOU rated, then the forward-looking price is simply the per-MOU TELRIC. In short, the
47 forward looking price referred to in a TELRIC analysis is the output of a TELRIC
48 analysis, not input in a TELRIC analysis.

49 To avoid confusion, I shall refer to the single price equivalent generated by ARPSM
50 either by its default name (single price equivalent) or as the per-line marginal cost of
51 acquiring the additional lines specified in the vendors' contracts — rather than using Mr.
52 Palmer's definition of "forward-looking" price. Also I shall refer to the per-line TELRIC
53 either by its default name (per-line TELRIC) or as the forward-looking price if the
54 element is flat-rated.

55
56 **Q. Please explain what you mean when you refer to market prices and network**
57 **structure.**

58
59 **A. In this context, Ameritech's market price refers to the price that the vendors charge**
60 **Ameritech. With two-tiered pricing, it refers to the prices specified in the vendors'**

³ "Switching element" is the same as network element and it refers to line port, CCS and trunk port. See Foot Note 2.

⁴ Note that the "Per-line TELRIC" refers to per-line-port TELRIC if the TELRIC mentioned refers to the TELRIC associated with line ports. "Per-line TELRIC" refers to the "per-trunk TELRIC" if the mentioned TELRIC is associated with trunk ports.

contracts. Network structure refers to the number of Total Switched Access Lines In Services (TSALIS) and the replacement/growth line-mix. The line-mix is relevant only if "two-tiered" pricing is adopted, and with "one-tiered" pricing, the only relevant element is the TSALIS. As shall be seen, market prices and network structure are vital in determining the TELRIC and forward-looking price of switching.

Q. Throughout his testimony, Mr. Palmer uses the single price equivalent (from ARPSM) as if it were the single market price. Can you describe the relationship between the per-line TELRIC and the single market price (assuming one-tiered pricing is adopted) ?

A. Yes. To illustrate this, assume that Ameritech pays the same prices for lines, regardless of whether they are for expansion or replacement of the system.

In this case, the TELRIC can be obtained by applying the market price to Ameritech's network structure. For example, assume that Ameritech's (per line) single market prices for switching element are \$120 (2001) and \$100 (2002) and that Ameritech's network has 1,000,000 (2001) and 1,500,000 (2002) switched access lines. The TELRICs of switching are:

$$\text{Year 2001: } \$120,000,000 = \$120 \times 1,000,000,$$

$$\text{Year 2002: } \$150,000,000 = \$100 \times 1,500,000.$$

The per-line TELRIC of switching are:

82 Year 2001: $\$120 = \$120,000,000/1,000,000$,

83 Year 2002: $\$100 = \$150,000,000/1,500,000$.

84 The per-line TELRIC of switching are simply the (per line) market prices of the switching
85 element. Therefore, with one-tiered pricing, one does not need to do a TELRIC
86 analysis to derive the per-line TELRIC of switching.

87 A key underlying assumption (in the above example) is that Ameritech is a price-taker in
88 the switching equipment market. This implies that the switching equipment market is
89 highly competitive and that the market prices (\$120 and \$100 in the above example)
90 would not be influenced by Ameritech's quantity of purchase. Under this assumption,
91 Ameritech would pay the same market prices regardless of whether it is purchasing only
92 a few lines to accommodate growth or many lines to replace the entire switching
93 network.

94 This price-taker assumption may not perfectly reflect the reality of switching equipment
95 markets, *but it is a reasonable assumption. And, moreover, it is used throughout almost*
96 *all TELRIC analysis.*

97

98 **Q. Does Mr. Palmer assume that Ameritech is a price-taker?**

99

100 A. Yes, but in a specific sense. In his rebuttal testimony, Mr. Palmer states (AI Ex. 2.1,
101 p10:12-15):

102 "This single price per line calculated by ARPSM represents the best
103 estimate of the forward-looking market price the switch vendors would

charge Ameritech for any quantity of new lines and is, therefore, the appropriate price estimate to use in TELRIC analysis." (Emphasis added)

That is, Ameritech can buy any quantity of lines with any line-mix at the single price equivalent (generated by ARPSM).

Q. What other key assumption has Mr. Palmer made in his testimony?

A. In addition to the assumption that Ameritech is a price-taker, Mr. Palmer also assumes that the single price equivalent generated by ARPSM can be used as if it were the single market price associated with one-tiered pricing. Specifically, Mr. Palmer states that the single price equivalent is the single market price "that the vendor would charge, were it to replace its two-tiered pricing structure with a single per-line price." (AI Ex. 2.1, p10: 10-12) In short, Mr. Palmer equates the single price equivalent (associated with two-tiered pricing) with the single market price (associated with one-tiered pricing) and uses this single price equivalent in place of the single market price when doing his TELRIC analysis. I will discuss this problem in more detail later.

Q. Based on Mr. Palmer's assumption that the single price equivalent and the single market price are equivalent, has Mr. Palmer done his TELRIC and forward-looking price analysis properly (AI Ex. 2.1, p20:12-22)?⁵

⁵ Note that the "forward-looking price" here refers to the output of a TELRIC analysis. It is not the "forward-looking" price defined by Mr. Palmer, which is virtually the (per line) marginal cost of acquiring the additional lines specified in the vendors contracts.

124

125 A. Yes. If the single price equivalent and the single market price are equivalent, one can
126 just use the single price equivalent in place of the single market price. As a price-taker,
127 Ameritech would pay this single price equivalent (i.e., the single market price) for each
128 line it purchases, regardless the quantity or mix of lines to be purchased. As discussed
129 earlier in this testimony, with a single market price, the TELRIC and forward-looking
130 price analysis is straightforward. The per-line TELRIC is simply the single market price.
131 The TELRIC is obtained by multiplying the single market price by the size of the
132 switching network — i.e., the total switched access lines in services (TSALIS). As a
133 result, the single price equivalent generated from ARPSM is also the per-line TELRIC of
134 switching. Thus, based on Mr. Palmer's assumption that the single price equivalent and
135 the single market price are "equivalent", Mr. Palmer has conducted his TELRIC and
136 forward-looking price analysis properly.

137

138 **Q. What is the implicit assumption that Mr. Palmer makes concerning the two-tiered**
139 **market prices?**

140

141 A. By asserting that Ameritech can buy any quantity and mix of lines at the single price
142 equivalent (AI Ex. 2.1, p10:12-14), Mr. Palmer implicitly assumes that the vendors would
143 adjust the two (replacement-growth) market prices to maintain approximately the same
144 single price equivalent, following a change in the line-mix or quantity of Ameritech's
145 purchase. As a result, in Mr. Palmer's analysis, the single price equivalent would remain
146 the same regardless of the quantity or line-mix of Ameritech's purchase.

147

148 **Q. Is this assumption consistent with the assumption that Ameritech is a price-**
149 **taker?**

150

151 A. No. The assumption that the vendors would adjust the two (replacement-growth)
152 market prices to maintain approximately the same single price equivalent seems to be
153 inconsistent with Mr. Palmer's assumption that Ameritech is a price-taker. As a price-
154 taker, Ameritech should not be able to influence the market prices by changing its
155 quantity or line-mix of purchase. Mr. Palmer seems to assume that Ameritech is a
156 price-taker when the vendors use one-tiered pricing and that Ameritech is not a price-
157 taker when the vendors use two-tiered pricing. I don't see how the vendors' pricing
158 structure would influence the competitiveness of the market, which is the key underlying
159 the price-taker assumption. Neither can I see how Ameritech could be able to exercise
160 influence on the two market prices (associated with two-tiered pricing) but not able to
161 exercise influence on the single market price (associated with one-tiered pricing).

162 Ameritech's role (as a price-taker or price-setter) on the switching equipment market
163 should be defined in terms of the market prices, not in terms of some hypothetical prices
164 (such as the single price equivalent).

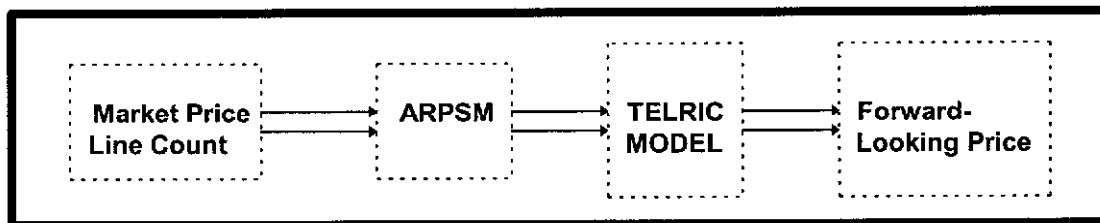
165

166 **Q. Mr. Palmer distinguishes between the TELRIC analysis and ARPSM (AI Ex. 2.1,**
167 **p20:13-21). Do you agree that ARPSM is not a designated TELRIC model?**

168

A. Yes, conceptually speaking. ARPSM is intended to generate the single price equivalent, which is to be used as input in the TELRIC analysis (see Chart 1 below). In other words, ARPSM is meant to be an input-generator for the TELRIC analysis. However, Mr. Palmer's use of the term "forward-looking" price may be misleading and tends to give the impression that ARPSM is meant to be a TELRIC model. As discussed earlier in this testimony, Mr. Palmer defines his "forward-looking" price as the single price equivalent generated by ARPSM and then uses his "forward-looking" price as input in his TELRIC analysis. In contrast, the "forward-looking" price constantly referred to in a TELRIC analysis is the output of the TELRIC analysis — it is the per-line or per-MOU TELRIC or a hybrid of the two. Therefore, ARPSM is not a designated TELRIC model, Mr. Palmer's use of the term "forward-looking" price may mistakenly give the impression that it is.

Chart 1: Ameritech's Process of Calculation



Q. Given that ARPSM is not a TELRIC model and that the output of ARPSM is used as input in Mr. Palmer's TELRIC analysis, does this mean that the output of ARPSM is different from the output of Mr. Palmer's TELRIC analysis ?

197 **A.** No. In describing the relationship between the output of ARPSM and the output of his
198 TELRIC analysis, Mr. Palmer states:

199 "The conversion of ARPSM's results into investments suitable for use in a
200 TELRIC model occurs when the forward-looking price of switching
201 generated by ARPSM is multiplied by the total number of switched lines
202 in services in Ameritech's network (to calculate the total investment
203 required to replace the entire network), and is then divided by the total
204 number of switched lines in services in Ameritech's network (to convert
205 the total investment into an investment per switched line)." (AI Ex. 2.1,
206 p20: 15-21)

207 That is, Mr. Palmer derives his TELRIC by multiplying the single price equivalent
208 generated by ARPSM by the number of Total Switched Access Line In Service
209 (TSALIS). The output of his TELRIC analysis (i.e., the per-line TELRIC⁶) is then
210 derived by dividing the TELRIC by the number of Total Switched Access Line In Service
211 (TSALIS). In other words, Mr. Palmer obtains the output of his TELRIC analysis (i.e.,
212 the per-line TELRIC) by multiplying and dividing the single price equivalent by the same
213 factor — i.e., TSALIS. As a result, the output of his TELRIC analysis (i.e., the per-line
214 TELRIC) will necessarily be identical to the output of ARPSM (i.e., the single price
215 equivalent).

⁶ The "per-line-port TELRIC" and the TELRIC of line port essentially "equivalent", in the sense that the TELRIC can be obtained by multiplying the per-line-port TELRIC by the TSALIS. Similarly, the "per-line-port TELRIC" can be obtained by dividing the TELRIC of line port by the TSALIS. The same is true for the "per-trunk TELRIC" and TELRIC of trunk port.

217 **Q. Given that ARPSM is an input-generator for the TELRIC analysis, can you explain**
218 **why the output of Mr. Palmer's TELRIC analysis is identical to the output of**
219 **ARPSM (i.e., the input of the TELRIC analysis) ?**
220

221 A. Yes. As discussed earlier, ARPSM is an input-generator for the TELRIC analysis by
222 design. And conceptually speaking, ARPSM and TELRIC model are two entirely
223 different models. However, when Mr. Palmer equates the single price equivalent with
224 the single market price (associated with one-tiered pricing), and uses it in his TELRIC
225 analysis, he effectively equates the single price equivalent with the per-line TELRIC. In
226 other words, Mr. Palmer effectively equates the output of ARPSM with the output of his
227 TELRIC analysis. This is because, as discussed earlier, when the vendors adopt one-
228 tiered pricing, the single market price is the per-line TELRIC. While conceptually
229 different, the distinction between the output of ARPSM (i.e., single price equivalent) and
230 the output of Mr. Palmer's TELRIC analysis (i.e., per-line TELRIC) is at best artificial.
231

232 **Q. Is ARPSM an appropriate input-generator for the TELRIC analysis? Or**
233 **specifically, is Mr. Palmer correct in using the single price equivalent (output of**
234 **ARPSM) as input in his TELRIC analysis?**
235

236 A. No. As discussed before, Ameritech as a price-taker should take the two-tiered market
237 prices as given, not the single price equivalent. The single price equivalent is not a
238 market price. It is a derived price, derived from the two-tiered (replacement/growth)
239 market prices and the quantity and mix of the additional lines specified in the vendors'
240 contracts. Strictly speaking, the single price equivalent is the per-line "marginal cost" of

241 acquiring the additional lines specified in the vendors' contracts. Or it is the per-line
242 price of the "marginal purchase". Unlike any single market price, this marginal
243 price/cost is contingent on the quantity and line-mix of the "marginal purchase". To apply
244 this marginal price/cost to the entire network will not yield the correct TELRIC of
245 switching unless the entire network has the identical line-mix as the marginal purchase
246 does. From the data in ARPSM, this marginal purchase has a (melded) line-mix of ***
247 (replacement) and *** (growth). From my own analysis (described in detail later), the
248 entire network, including the marginal purchase, has a line-mix of **** (replacement) and
249 **** (growth). As the growth line prices are higher than the replacement line prices, the
250 application of the per-line price of the marginal purchase (i.e., the single price
251 equivalent) to the entire network would overstate the TELRIC and per-line TELRIC of
252 switching. Therefore, ARPSM is not an appropriate input-generator for the TELRIC
253 analysis.

254
255 **Q. As mentioned above, Mr. Palmer implicitly assumes that the vendors would adjust**
256 **the two-tiered market prices to maintain approximately the same single price-**
257 **equivalent. That is to say, the two-tiered prices would be significantly influenced**
258 **by changes in the line-mix of Ameritech's purchase. Do you agree ?**

259
260 **A.** No. The two-tiered pricing structure is driven by the expectation that Ameritech would
261 purchase all expansion lines and periphery equipment (such as software) from the same
262 vendors that installed the original switches. The discount on the replacement line prices
263 has more to do with the growth rate (and cost of capital) and less to do with the line-mix
264 at each point in time. To illustrate, assume that the life of a switch is 4 years and the

growth rate is 5%, and the two-tiered market prices are \$90 (replacement) and \$100 (growth). To sell 100 replacement lines in year 2001 would generate an additional sale of 5 growth lines in each of the subsequent years (2002, 2003, 2004). The value created by the 100 replacement lines would be:

$$\underline{\$10,500} = \underline{\$90} \times \underline{100} + \underline{\$100} \times \underline{5} + \underline{\$100} \times \underline{5} + \underline{\$100} \times \underline{5}.$$

(Assuming the cost of capital is zero, for simplicity) The total value created by each replacement line would be \$105, which is higher than the replacement price of \$90.

Therefore, replacement and growth lines differ in terms of revenue generating capability.

In the above example, while the value created by a growth line is \$100, the value created by a replacement line is \$105, not the replacement line price of \$90.

In general, the total value created by each replacement line is a function of the growth rate, the replacement/growth line prices, and other factors (such as cost of capital and cost of producing switches and market demand). It is this total value created by each replacement line that principally decides the replacement-growth price-mix, not the line-mix at a given point in time *per se*.

Q. Do you agree with Mr. Palmer's view that the entire network structure is irrelevant in a forward-looking cost analysis ?

A. No. In his rebuttal testimony, Mr. Palmer states:

"....., the portions of Ameritech facilities that "have been" placed at switch installation versus facilities that "have subsequently been" placed

287 to accommodate growth are not relevant in a forward-looking cost
288 analysis." (AI Ex. 2.1, p9:15 -17)

289 As discussed above, the forward-looking price of switching is derived based on the
290 TELRIC of the switching element, and the TELRIC should be derived by applying the
291 market prices (current and future) to the structure of the entire network. Therefore, the
292 entire network is relevant in the TELRIC and forward-looking price analysis.

293

294 **Q. You mention earlier in this testimony that TELRIC should be obtained by applying**
295 **the market (replacement/growth) prices to the entire network structure, not just to**
296 **the marginal purchase (specified in ARPSM Documentation and the vendors**
297 **contracts). Is the TELRIC thus an embedded cost ?**

298

299 **A.** No. Embedded and forward-looking costs are two entirely different concepts. The
300 embedded cost of switching reflects the actual cost incurred by Ameritech for the entire
301 network of switching. The TELRIC is the total costs of the entire network of switching
302 element when current prices are applied to the entire network. For example, assume
303 that Ameritech replaced its entire network (say, 1,000,000 lines) in 2000 at per-line price
304 of \$50. In 2001, Ameritech is to purchase 100,000 expansion lines and replace 400,000
305 of its existing lines (hypothetical). The replacement/growth line prices in 2001 are \$45
306 and \$60. The total embedded cost of the entire network of the switching element in
307 2001 is

308
$$\underline{\$54,000,000} = \underline{\$50} \times \underline{600,000} + \underline{\$45} \times \underline{400,000} + \underline{\$60} \times \underline{100,000},$$

and the per-line embedded cost of switching is $\$49.09 = \frac{\$54,000,000}{1,100,000}$. The TELRIC in 2001, in contrast, is: $\$51,000,000 = \$45 \times 1,000,000 + \$60 \times 100,000$, and the per-line TELRIC of switching in 2001 is $\$46.36 = \frac{\$51,000,000}{1,100,000}$.

The TELRIC in 2001 reflects only the market prices in 2001 and is independent of the market prices in 2000. As the prices decline over time in the above example, the per-line TELRIC of switching in 2001 ($\$46.36$) is lower than the per-line embedded cost of switching ($\$49.09$) in 2001.

Q. Do you agree with Mr. Palmer that the past prices or pricing structure of switching elements are irrelevant to the TELRIC and forward-looking cost analysis (AI Ex. 2.1, p23-p24)?

A. Yes. While past prices or pricing structure are reflected in embedded costs, they are irrelevant to any forward-looking cost concepts. By definition, TELRIC is the total costs of the switching element when the current market prices are applied to the network structure. It is totally independent of the past prices or pricing structure. This remains true regardless of whether the vendors use (or used) one-tiered or two-tiered pricing structure.

Q. Mr. Palmer describes the single price equivalent generated by ARPSM as the "forward-looking market price" (AI Ex. 2.1, p15: 1). Is this correct ?

330

331 A. No. As discussed earlier, the single price equivalent is not a single market price. It is
332 the marginal price, or the per-line price for the marginal purchase specified in the
333 vendors' contracts. And it is contingent on the quantity and line-mix of the marginal
334 purchase. The prices that Ameritech is expected to pay are the two-tiered market
335 prices.

336

337 **Q. Putting the issue of Ameritech's role (as a price-taker or price-setter) aside, can**
338 **the single price equivalent be the single market price ?**

339

340 A. No. The two-tiered pricing is driven by the expectation that Ameritech would only
341 purchase expansion lines and periphery equipment (such as software) from the same
342 vendor that installed the original switches. By lowering the prices on replacement lines,
343 the vendors would be able to generate additional sales of replacement lines, which
344 would, in turn, generate additional sales of expansion lines and additional profits in the
345 future. This is mainly a marketing strategy, commonly known as "introductory pricing".

346 The single price equivalent generated by ARPSM is the "hypothetical price" that offers
347 the vendors the same revenues as the two-tiered market prices do if the quantity and
348 mix of lines to be purchased at this hypothetical price are exactly the same as that under
349 two-tiered pricing. Were the vendors (forced) to replace two-tiered with one-tiered
350 pricing, the single market price in general would not be the same as the single price
351 equivalent associated with the two-tiered pricing (assuming both the vendors and
352 Ameritech are rational economic agents). This is explained as follows.

353 First, while the replacement and growth lines are functionally identical from the viewpoint
354 of the endusers, they differ in terms of revenue-generating capability. The vendors
355 would prefer two-tiered to one-tiered pricing, as two-tiered pricing offers differentiated
356 treatment of "different" lines (replacement/growth). It is worth noting that under two-
357 tiered pricing, while the vendors have the choice of charging different prices for different
358 lines (replacement/growth), they don't have to do so. If it is more profitable, the vendors
359 would choose to use one-tiered pricing. Thus, when they do use two-tiered pricing, it
360 implies that the two-tiered pricing offers the vendors better payoff than the one-tiered
361 pricing does. If the vendors were (forced) to replace two-tiered with one-tiered pricing,
362 the vendors' profitability would decline and single market prices would deviate from the
363 single price "equivalent".

364 Secondly, the single price "equivalent" would no longer be equivalent. The
365 "equivalency" between the two-tiered market prices and the single price equivalent
366 generated by ARPSM is critically founded on the assumption that the quantity and mix of
367 lines to be purchased at this hypothetical price (i.e., the single price equivalent) are
368 exactly as same as that under the two-tiered pricing. However, Ameritech, as a rational
369 buyer, would respond to changes in market prices or pricing structure. If the vendors
370 were (forced) to replace "two-tiered" with one-tiered pricing and set the single market
371 price at the single price equivalent, Ameritech would respond to this change in market
372 conditions by altering the quantity and line-mix of its purchase. This would undermine
373 the foundation for the "equivalency". As a result, the single price equivalent would not
374 be equivalent from the vendors' viewpoint.

375 The would-be responsiveness of Ameritech to changes in the vendors' pricing structure
376 (i.e., between two-tiered and one-tiered pricing) is manifested by the fact that the

vendors do adopt two-tiered pricing. Put differently, if Ameritech is not significantly responsive to the change between two-tiered and one-tiered pricing, the vendors would not be able to gain much by practicing two-tiered pricing, compared to the one-tiered pricing with the single market price set at the single price equivalent. So the vendors' adoption of two-tiered pricing itself manifests that Ameritech would respond significantly to changes in the vendors' pricing structure.

Generally speaking, the single price equivalent (associated with two-tiered pricing) is not the same as the single market price (associated with one-tiered pricing).

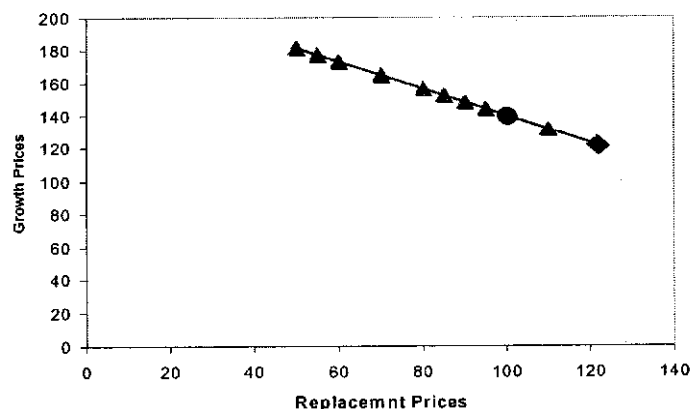
Q. Is there any additional fallacy in Palmer's argument in support of his use of the single price equivalent as the would-be single market price ?

A. Yes. Mr. Palmer uses the single price equivalent (associated with two-tiered pricing) as the would-be single market price (associated with one-tiered pricing). One main justification provided by Mr. Palmer is that the single price equivalent offers the vender the same total payment for Ameritech's marginal purchase (specified in the ARPSM Documentation and vendors' contracts) as the two-tiered market prices do. Therefore, were the vendors to replace its two-tiered with one-tiered pricing, the vendors would charge the single price equivalent (AI Ex. 2.1, p10:10-11). This argument, however, is in no way valid for supporting the use of the single price equivalent (with two-tiered pricing) in place of the would-be single market price (with one-tiered pricing).

For the quantity and line-mix of Ameritech's marginal purchase (specified in ARPSM Documentation and vendors' contracts), I can come up with countless sets of "two-

tiered price equivalent" that would offer the vendors the same total revenue (payment) as the two-tiered market prices (specified in the vendors' contracts) do. To illustrate, assume that the present values of the line counts (from the vendors' contracts) are 150 (replacement) and 180 (growth) and that the two-tiered market prices are \$100 (replacement) and \$140 (growth). The total revenue the vendors generate from the marginal purchase is \$40,200. The single price equivalent in this case would be \$121.82. However, the two-tiered market prices and the single price equivalent are not the only two sets of prices that offer the vendors \$40,200 in revenue on the marginal purchase. In fact, there are countless two-tiered price equivalents that would accomplish the same goal for the vendors. In Chart 2 (below), I present a few of such two-tiered price equivalent. The red diamond represents the single price equivalent and the blue circle represents the actual two-tiered market prices (in this example). All others are two-tiered price equivalents, which offer the vendors the same total revenue as the actual two-tiered market prices do.

Chart 2: Sets of "Equivalent" Prices



415 According to Mr. Palmer (Id.), the vendor would charge the single price equivalent were
416 it to adopt one-tiered pricing, because the single price equivalent offers the same total
417 payoff. Using the same logic, then all these two-tiered price equivalents are (would-be)
418 two-tiered market prices under two-tiered pricing, as they all offer the vendor the same
419 total payoff as the actual two-tiered market prices (\$100 & \$140 in the above example).
420 However, as we know for fact, the only two-tiered market prices are \$100 (replacement)
421 and \$140 (growth) in the above example. In other words, "equivalent" does not mean
422 that the "price equivalent" can be the "market price". Therefore, the fact that the single
423 price equivalent offers the same total payoff can be not used as the justification for
424 using the single price equivalent in place of a single market price.

425
426 **Q. Mr. Palmer refers to the single price equivalent as the best estimate of the single**
427 **market price (AI Ex. 2.1, p10: 12-13). Do you agree ?**

428
429 **A** No. In many occasions, economic information required is not directly available. In this
430 situation, one will have to make do with some estimators of the economic variables.
431 However, this does not mean that every estimator or every method of estimation is
432 acceptable. Mr. Palmer's estimate of and his attempt to estimate the single market
433 price that would exist if the vendors were to adopt one-tiered pricing do not seem to be
434 justified. First, the information on market prices is available — the two market prices are
435 quoted in the vendors' contracts — and they can be readily imported into the TELRIC
436 analysis as inputs. Secondly, Mr. Palmer's estimate of the single market price is based
437 on some flawed assumptions. As discussed above, the vendor would not charge the

438 single price equivalent as its single market price were it to replace the two-tiered with
439 one-tiered pricing, nor would Ameritech stay unresponsive to the change in the vendor's
440 pricing structure.

441 In short, while estimators of economic variables are often used, Mr. Palmer's estimation
442 is neither necessary nor is it based on sound economic foundation.

443

444 **Q. You mentioned that both the two-tiered market prices and the network structure**
445 **should be used in a TELRIC analysis. Do you have all information you for the**
446 **calculation of the per-line TELRIC?**

447

448 **A.** No. Ameritech is only able to provide information on analog switch replacement from
449 1991 to 2000. No information on analog switch replacement prior to 1991 is available.

450

451 **Q. Without any information on analog switch replacement prior to 1991, how would**
452 **you obtain the line-mix for the entire network ?**

453

454 **A.** Ideally, I would like to use the actual line counts — i.e., the numbers of lines replaced in
455 each year since the start of analog switch replacement. With no information on analog
456 switch replacement prior to 1991, the matter is not, however, as hopeless as it appears
457 to be.

458 It is well established in the literature of diffusion of new products that the penetration of
459 a new product follows certain regularity. This regularity can be characterized by a S-

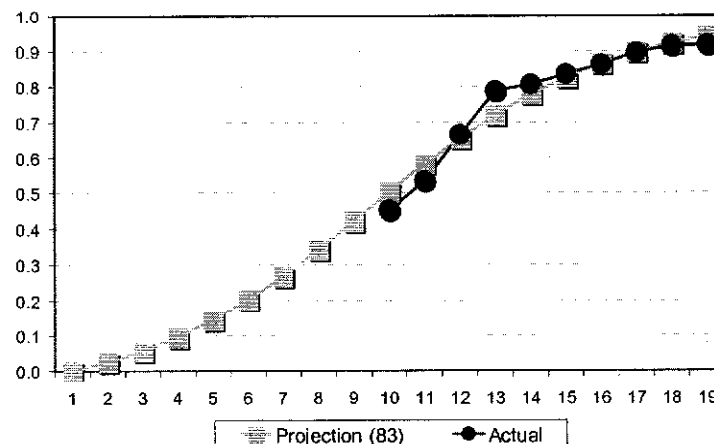
curve. This S-curve, in turn, is generally represented by a form of the *hyperbolic tangent function*. I use a *compounded hyperbolic tangent function* to project the digital switch penetration prior to 1991.⁷

Q. Can you describe the projection you have made on digital switch penetration and how well it describes the actual digital switch penetration from 1991 onward ?

A. I assume that significant (above 2%) analog switch replacement started at 1983. In Chart 3 (below), I present my projection (1983-2000) and the actual (1991-2000) of digital switch penetration for Ameritech five states. The horizontal axis represents the time period with 1982 as period 1 (in which the digital switch penetration is zero), and the vertical axis represents the percentage of lines that are on digital switches (i.e., digital switch lines). The light blue curve is my projection of digital switch penetration of Ameritech five states from 1983 to 2000. The purple curve represents the actual digital switch penetration from 1991 to 2000. The average error of projection is 0.97% and the average of absolute error of projection is 3.9%. Therefore, the projection has a very high level of "goodness of fit".

⁷ The mathematical foundation for the projection of digital switch penetration is available upon request.

Chart 3: DIGITAL SWITCH PENETRATION



479

480

481

482 **Q. Do you also have to develop a separate procedure to make a projection regarding**

483 **the percentage of replacement lines in each year?**

484

485 **A.** Yes. The projection of digital switch penetration is not my ultimate goal but a

486 steppingstone for the projection of line-mix in 1996. In doing the projection, I take into

487 account the fact that the growth rate on digital switches is much higher than the growth

488 rate on analog switches.⁸

489

490 **Q. Why do you only need the projection for 1996, not the years after ?**

491

⁸ The mathematical foundation of my projection for percentage of replacement lines is available upon request.

A. My principle is to use the actual data whenever possible. Since 1997, Ameritech's purchases are described in the vendors' contracts and ARPSM Documentation. With the total access lines in service (19,553,000) and the projection on the percentage of replacement lines in 1996, I am able to calculate the projected number of replacement lines in 1996. Combining the total number of replacement lines in 1996 with information offered in ARPSM Documentation and the vendors' contracts, I am able to calculate the projected line-mix for the entire network, which includes the additional lines specified in ARPSM documentation and the vendors' contracts. The projected line-mix for the entire network is **** (replacement) and **** (growth).

Q. What are the single line prices based on your line-mix for the entire network ?

A. Using the information given in ARPSM Documentation on analog/digital line-mix and my projected replacement/growth line-mix, I calculate the single prices for each vendor and the melded (weighted average over the three vendors):

	Lucent	Nortel	Siemens	Melded
Line Price (CCS Included)	\$****	\$****	\$****	\$****
Line Price (CCS Excluded)	\$****	\$****	\$****	\$****
CCS per Line	\$****	\$****	\$****	\$****

Note that the per-line CCS in the above table is different from the per-line CCS cost developed in ARPSM. From ARPSM, the per-line CCS cost is ***** (Lucent), ***** (Nortel) and ***** (Siemens) of the total per-line cost. I apply these percentage factors

to the total per-line price that I have developed to derive the per-line CCS cost. This method is justified as follows.

The per-line CCS developed in ARPSM is really the single per-line CCS. When Ameritech pays different prices for different lines, Ameritech also pay different (implicit) prices for per-line CCS, depending on the type of the line with which the CCS is associated. It is reasonable to assume that the pricing structure on (implicit) CCS cost is parallel to that on lines. That is, it is reasonable to assume that the percentage of discount on "replacement" CCS is the same as that on replacement lines. Under this assumption, the per-line CCS cost as a percentage of the per-line cost would be the same across all types of lines. And the (single) per-line CCS cost would also be the same as a percentage of the single per-line price. Therefore, it is reasonable to apply this percentage factor to my single line prices to derive the per-line CCS cost.

Q. Do you also calculate the single trunk prices ?

A. Yes. I apply the line-mix of ***** (replacement) and ***** (growth) to the replacement/growth trunk prices and obtain the following single trunk prices:

	Lucent	Nortel	Siemens	Melded
Trunk Price	\$*****	\$*****	\$*****	\$*****

Q. Do you also calculate the single Right-To-Use (RTU) fees ?

A. Using the same method that I use in deriving the single trunk prices, I calculate the following single RTU:

	Lucent	Nortel	Siemens	Melded
RTU	\$*****	\$*****	\$*****	\$*****

Note that in the Nortel contract, the RTU is assessed on the whole switch, not on each individual replacement line. I use the derived per-line RTU from ARPSM and use the average of the five RTU (for five different years) in place of the per replacement line RTU fee. Given that per replacement line RTU fees for different years (derived in ARPSM) do not vary much over time and that RTU is a small percentage of the per-line switch cost, this simplification is justified.

Q. Do you also calculate the port charges ?

A. Yes. With the single melded line price, Revenue Ready (RR) fee, RTU and other items (such as MDF/DSX, INTERCEPT, TELEPHONE NUMBER, DIRECTORY, etc.) provided by Ameritech in the ULS cost study, I am able to calculate the following "Port Total" (i.e., the per-line TELRIC).

	Port Total
CCS Excluded	\$*****
CCS Included	\$*****

I then apply the percentage of "shared & common" developed by Staff witness Marshall to the "Port Total" to derive the monthly "Port Charge".

	Port Charge	Shared & Common
CCS Excluded	\$*****	*****%
CCS Included	\$*****	*****%

Part II.2: CCS-related Investment

Q. The two major issues concerning CCS investment debated by Dr. Ankum and Mr. Palmer are: whether Ameritech has incurred CCS related cost, and whether recovery of CCS investment should be based on usage type of the ports. Do you agree with Mr. Palmer that Ameritech incurs CCS-related investment costs?

A. Yes. This point has been explicitly addressed by the Commission Order in Docket 96-0486: